

I. INTRODUCTION

The determination of carbon monoxide in cigarette smoke has been studied for some time. The recent interest of the FTC appears to be partially the result of receiving a grant from NIH to enable them to determine CO numbers as well as tar and nicotine figures.

II. BACKGROUND

Since the first Surgeon General's Report in 1964, carbon monoxide has been included among the harmful constituents of cigarette smoke. At present, it is covered in several sections of the recent Health Consequences of Smoking.

Carbon monoxide has a two-prong attack against it. One attack is against the addition of CO to air by smokers and this CO-laden air is then inhaled by non-smokers. The other prong is looking at the issue of what damage does increased carboxyhemoglobin (COHb) cause in smokers. Does the exposure to the levels of CO in smoke present a real health hazard to smokers and non-smokers and will publicizing these numbers cause a decrease in exposure are among the questions to be answered.

III. REPORTING OF CO LEVELS IN SMOKE

(5)
There are four ways to report CO levels in smoke: ppm, volume percent, mg/cigt., and mg/puff. All of the measurements are convertible to one another, i.e., to get ppm:

$$\frac{\text{ml CO/cigt.}}{\text{PC} \times 35\text{ml}} = \frac{\text{COppm}}{1,000,000}$$

where PC is puff count.

To go from mg/cigt. to ml/cigt.:

$$22.414(\text{temp. corr.})\left(\frac{\text{mg/cigt.}}{30}\right) = \text{ml/cigt.}$$

If CO is reported in mg, the numbers will fall in line with the tar figures. (See following discussion on CO and tar deliveries.) These numbers will be the same order of magnitude as tar numbers and should have no effect on the public.

In Germany CO is reported as volume %. It is felt that in the U.S., toxicologists and air pollution specialists will push to have CO concentration published as ppm. This will give the largest possible number. Threshold limit values are reported in ppm and OSHA and other governmental agencies will try to keep CO reports in volume figures. The TLV for CO is 50 ppm, and thus it would be easy to state a cigarette exceeded the TLV.

IV. THE NON-SMOKER ASPECT

CO is the constituent of tobacco smoke that has caused the environmentalists and others to legislate for laws prohibiting smoking in public areas and work places. Dr. Morton Corn, Assistant Secretary of Labor and Director of OSHA, is an authority on atmospheric pollution from cigarette smoking and has just recently banned smoking at OSHA meetings to prevent subjecting nonsmokers to any harmful constituents. Thus, OSHA will be sympathetic to any person or groups petitioning to ban smoking where the nonsmoker can be affected.

In the 1975 Health Consequences of Smoking, the amount of CO generated by cigarette and cigar smoking in enclosed spaces is given. (See attached Table 2.) Only under extreme conditions, usually no ventilation which is unrealistic, does the CO concentration exceed 50 ppm (the TLV). Nonsmokers under experimental conditions in smoke-filled rooms experience an increase in their COHb. The increases measured are probably not significant in a healthy adult. However, it would have an impact on someone with heart disease.

For a fuller discussion on this aspect, Dr. Wakeham has prepared a report entitled, "Nonsmokers and Carbon Monoxide from Cigaret Smoking."

V. THE SMOKER ASPECT

CO impairs oxygen transport two ways. First, it competes with O₂ for the binding sites on hemoglobin and, second, the remaining hemoglobin has an increased affinity for oxygen; thus requiring a larger gradient between blood and tissue to deliver a given amount of oxygen. CO also binds to myoglobin with a greater affinity than for hemoglobin. This might be significant in such tissues as the heart muscle, which requires both high oxygen levels and large quantities of myoglobin.

It is well known that smokers have increased levels of COHb. While some individual measurements and techniques are faulty, overall it has been shown that the level of COHb in smokers is increased and if they are exposed to environmental CO in their occupation, their COHb is still higher than the nonsmokers. (See attached Tables 4 and 5.)